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ABSTRACT

"Inquiry Training," a teaching technique promoted during the 1960s, involves students gathering information about a discrepant event or puzzling situation, and formulating theories to explain the event. Continuing the work of two studies into the efficacy of Inquiry Training (subsequently renamed Cognition Enhancement), a more refined third study was conducted to determine whether Forms 2 and 3 of the Test of Cognition Enhancement Skills are equivalent; whether students' test scores would reach a plateau within 16 cognition enhancement instructional sessions, and whether students receiving cognition enhancement instruction would score significantly higher on the Test of Cognition Enhancement Skills than would control students receiving no such instruction. Students in grade 5 completed Forms 2 and 3 of the Test of Cognition Enhancement Skills, each item of which measures one of 18 cognition enhancement skills. The results indicated the following: (1) students with higher basic ability scored better on both the pretest and the posttest that did students with lower basic ability, (2) Forms 2 and 3 of the test were shown to be equivalent (3) multiple exposure to a specific form of the test resulted in slightly elevated test scores, (4) students who participated in 16 cognition enhancement sessions scored significantly higher than did control students, and (5) student growth in the cognition enhancement program did not reach a plateau during the 16 sessions. (Study data, subsets of cognition enhancement skills, schedules for cognition enhancement instruction, and Forms 2 and 3 of the Test of Cognition Enhancement are appended.) (HTH)

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AN EVALUATION OF THE EFFECTIVENESS OF THE COGNITION ENHANCEMENT TECHNIQUE FOR TEACHING A SELECTED GROUP OF COGNITIVE SKILLS

A Research Project Conducted
During the 1984-85 School Year

By

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I. The Background of the 1984-85 Research Program

During the 1960's, a teaching technique called "Inquiry Training" was developed and promoted by Richard Suchman, formerly on the staff of the University of Illinois. Inquiry Training was shown to be a teaching process which consisted of three primary parts:

A. Students were shown a "discrepant event", a puzzling situation which was intended to arouse curiosity.
B. The students were given an opportunity to gather information about the discrepant event by asking questions of the teacher.
C. The students were allowed and encouraged to formulate "theories" explaining the discrepant event.

During about a two-year period, roughly 1965 to 1967, a great amount of excitement about Inquiry Training was generated among school personnel in the Puget Sound region of the state of Washington. Extensive inservice training was conducted throughout the region for teams of teachers and administrators from numerous school districts.

At the time, serving in the capacity of Science Coordinator for Bellevue Public Schools, this researcher had mixed feelings about the technique. It appeared to be an exciting new way to teach; but it also appeared to him that most of the teachers whom he knew to be excited about it were looking upon it as a new way to teach facts and principles, rather than as a way to teach problem-solving skills or thinking skills.

For what appears to be a variety of reasons, interest in Inquiry Training declined rapidly. However, this researcher continued to harbor the feeling that this technique, or something similar to it, could be used to teach thinking skills effectively. Therefore, when time finally became available to him during the 1982-83 school year for the pursuit of research on this topic, he conducted a series of four levels of rather informal classroom research at Ardmore Elementary School in Bellevue. That research was intended to produce data that could be used as a basis for designing some more-refined, better-controlled subsequent research on the same topic. The four levels of research at Ardmore were termed Levels I through IV, respectively, and they involved four separate classes of students which were multi-level classes containing students of grades 3 through 6.

The major results of the research at Levels I to IV were as follows:

A. A highly productive series of focuses (discrepant events), and one having a great variety of subject matter was developed.
B. The teaching techniques were modified extensively and were refined.
C. The reaction of the students to the teaching technique was very positive.
D. A test over a set of measurable "thinking skills" was developed and refined on the basis of feedback.
E. After attempts were made to record and categorize all student actions during the sessions, it was concluded that this would be possible only if the sessions were videotaped and the tapes then analyzed in detail.
F. The growth of students in respect to the pre-test and post-test scores was "probably statistically significant"; however, no statistical test for significance was applied.
G. There seemed to be close to a zero correlation between overt participation by students and their growth as indicated by the test results; however, no statistical tests were applied.
H. The evaluation techniques were refined.
I. The participating teachers felt that the student growth was well worth the time spent in the sessions.

A detailed report of the research of Levels I through IV may be obtained from this researcher upon request.

As a result of the research at Levels I through IV, this researcher decided to change the name of the technique to Cognition Enhancement. That was because he had observed that a very definite set of skills, which he now calls the Cognition Enhancement Skills, were being exhibited and improved upon by the students as they participated in one session after another. And he felt the desirability of more aggressively pursuing the teaching of those skills (which are a subset of the higher cognitive levels) than had been the case with Inquiry Training. Also, he felt the need for other changes in the technique - changes which were so extensive as to warrant a change in the name of the technique. However, the three primary parts which were described earlier herein for Inquiry Training were retained in Cognition Enhancement.

The set of nineteen Cognition Enhancement Skills is listed on page 6. Also listed on that page are the higher-level cognitive skills which are closely associated with each Cognition Enhancement Skill. Appendix A shows three subsets of the Cognition Enhancement Skills. The Observable Skills are the same as those listed on page 6. The Measurable Skills are those which are measured by the various forms of the Test of Cognition Enhancement Skills which have been developed for use in evaluating the effectiveness of this teaching technique. Page 7 contains a Venn diagram of the interrelationships which this researcher perceives to exist among various groups of skills to which educators sometimes refer. It indicates, among other things, that the Cognition Enhancement Skills are a predominant, basic portion of the other sets of skills.

During the 1983-84 school year, additional research was conducted, using eleven classes of students ranging from third grade to seventh grade. The research was divided into Levels V through VIII, each having a different set of objectives. A summary of the major conclusions drawn from the results of that research is as follows:

A. A reasonable time for completing each item on the Test on Cognition Enhancement Skills was established.

B. Some students who usually don't participate verbally during traditional instructional activities in the classroom <u>did</u> participate in the Cognition Enhancement sessions.

C. Some students did <u>not</u> participate verbally in the Cognition Enhancement sessions.

D. Teachers found the use of the group approach in the Cognition Enhancement sessions to be very appealing.

E. Teachers felt that the time spent on the research series was highly justified by the results.

F. The students who were involved in the testing program as well as the instructional sessions had an overall neutral feeling about the series. But students who had only the instructional sessions had a very positive feeling about the series.

G. Form 1 and Form 2 of the Test on Cognition Enhancement Skills were shown to be statistically equivalent.

H. As measured by the Test on Cognition Enhancement Skills, students who participated in ten 45-minute Cognition Enhancement sessions demonstrated significant growth from pre-test to post-test.

I. The growth in actual skill level, as measured by the Test on Cognition Enhancement Skills, ranged from 49% for one of the classes to 155% for another class. The variation is probably partly a function of variations in basic ability level of the students, but might also be partly a function of one or more factors which should be studied in more detail in further research.

J. The cumulative effects of exposure to multiple instructional sessions did not reach a plateau within the span of thirteen sessions. This leads to the conclusion that exposure to more than thirteen sessions is advisable in order to bring about maximum growth in Cognition Enhancement skills.

K. Students of high ability tended to learn the Cognition Enhancement skills to a higher degree than did students of lower ability.

L. Students who participated overtly more tended to learn the Cognition Enhancement skills to a higher degree than did students who didn't participate overtly as much. But there are enough individual exceptions to this pattern to warrant caution against basing an estimate of an individual student's learning of the Cognition Enhancement skills on his or her overt participation.

M. The students' application of advanced Cognition Enhancement skills increased significantly during the series.

N. The length of the participation sequences by individual students increased significantly during the series.

O. The teaching methods used in the Cognition Enhancement sessions should be analyzed for the possibility of making changes that would result in more growth in the scores on some of the test items.

P. The test items to which reference is made in the above comment should be examined carefully in order to see whether the relatively low growth on those items could be due to flaws in the test items themselves.

Q. Overall, Form 1 and Form 2 of the Test on Cognition Enhancement Skills were shown to have a high level of validity and applicability in this study.

A detailed report of the 1983-84 research project may be obtained from the author upon request.

The analysis of the 1983-84 research project led this researcher to conclude that further research should be conducted inorder to overcome certain weaknesses of the 1983-84 project. It was decided that, in the additional research, the researcher should:

1. conduct a further evaluation of the number of instructional sessions which are needed to bring students to a significant plateau in growth in Cognition Enhancement Skills. Expose the students to a series of more than thirteen instructional sessions.

2. design the above research so that the effects of multiple use of the same form of the test can be evaluated and thus distinguished from that degree of growth which is a function of the instruction.

3. include a control group, one which is tested but which is not exposed to the instructional sessions.

It was primarily with the above three goals in mind that the 1984-85 research project was designed.

HIGHER-LEVEL COGNITIVE SKILLS
ASSOCIATED WITH THE OBSERVABLE COGNITION ENHANCEMENT SKILLS

Observable Cognition Enhancement Skill	Associated Higher-level Cognitive Skill
1. States hypotheses.	Synthesis?
2. Asks verification questions.	Comprehension
3. Asks experimentation questions	Comprehension Application
4. Re-words synthesis or necessity questions into an acceptable form.	Application
5. Avoids synthesis and necessity questions.	Comprehension
6. Words questions precisely.	Comprehension Application
7. Asks control questions.	Comprehension Application
8. Asks sequential series of questions.	Comprehension Synthesis
9. Uses data gathered by self as a basis for unique hypotheses.	Comprehension Analysis Synthesis
10. Builds on data gathered by other students.	Comprehension Synthesis
11. Uses data gathered by others as a basis for unique hypotheses.	Comprehension Analysis Synthesis
12. States hypotheses precisely.	Comprehension Synthesis
13. Points out data that confirm hypotheses.	Analysis
14. Points out data that invalidate hypotheses.	Analysis
15. Rejects own hypotheses when invalidating evidence is apparent.	Evaluation
16. Suggests changes in hypotheses on the basis of data gathered.	Analysis Synthesis Evaluation
17. Points out untested hypotheses.	Analysis
18. Points out and values greater specificity levels among hypotheses.	Evaluation
19. Tests hypotheses by gathering data independently.	Synthesis

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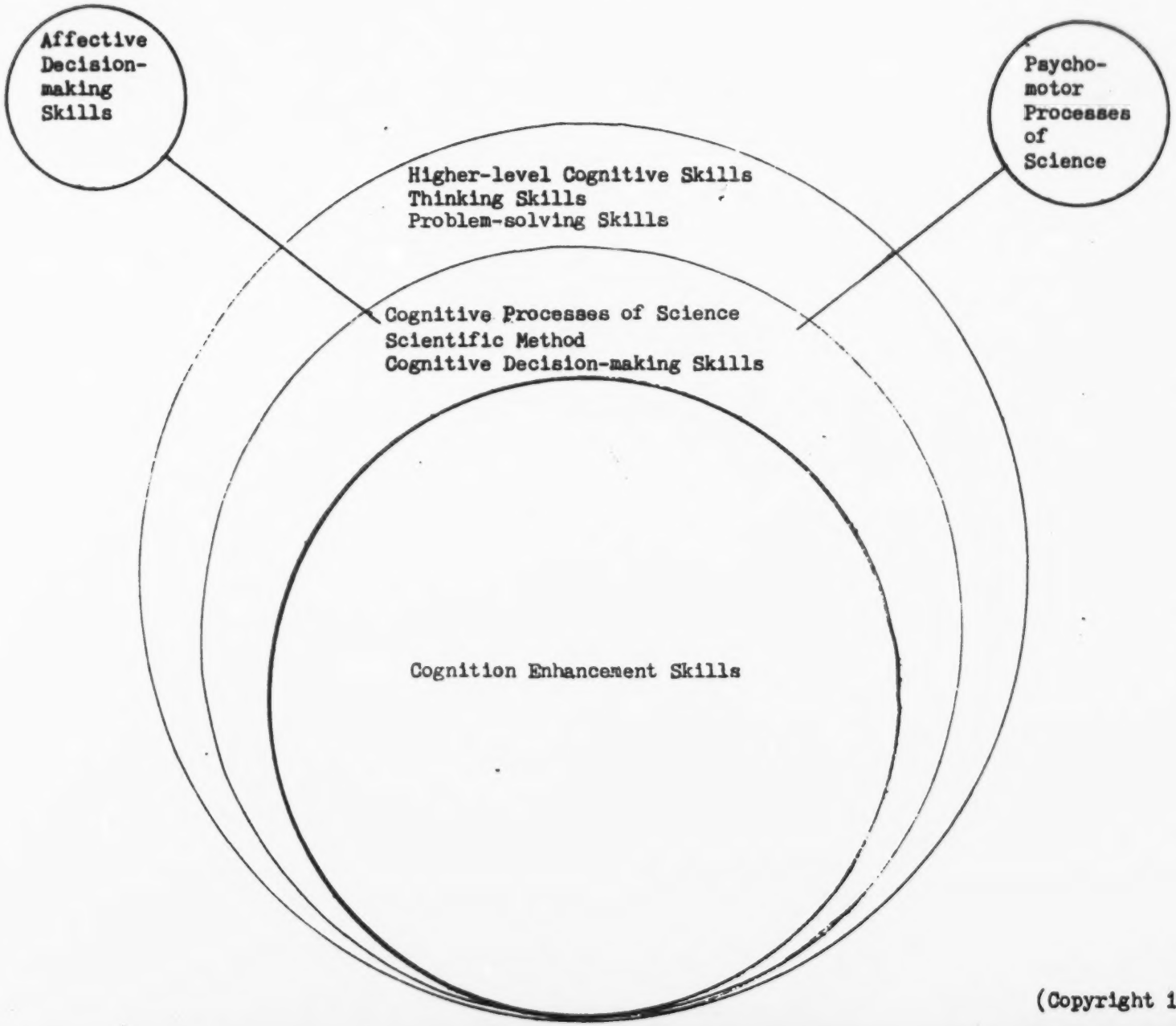
VENN DIAGRAM OF THE INTERRELATIONSHIPS BETWEEN VARIOUS SETS OF SKILLS



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II. The Structure and Intent of the 1984-85 Research Project.

The 1984-85 research project was designed with the results of the 1983-84 project in mind. With reference to the previous eight levels of research which had been conducted on this topic by this researcher, the 1984-85 project has been designated as Level IX. The general objectives of Level IX were as follows:

1. To determine whether Forms 2 and 3 of the Test of Cognition Enhancement Skills are equivalent.

2. To determine whether students reach a plateau in their scores on the Test of Cognition Enhancement Skills within sixteen instructional sessions.

3. To determine whether students in a group which receives instruction in Cognition Enhancement (experimental group) score significantly higher on the Test of Cognition Enhancement Skills than students in a group which has received no instruction (control group).

In order to acheive the above three objectives, a complex research schedule involving two experimental groups and two control groups was established. Those schedules are included herein as Appendix B.

The groups of students who participated in Level IX were intended to be typical, non-select classes of 5th-graders. This researcher had the primary responsibility for the activities of the students during the research sessions. The host teachers were asked to be present in the classroom at all times; however, their responsibilities toward the research sessions were negligible, and there was time for them to grade papers or to perform other similar routine tasks of their own choosing.

III. The Evaluation Instruments and Techniques Which Were Used.

In order to measure student growth in respect to the Cognition Enhancement Skills, Forms 2 and 3 of the Test of Cognition Enhancement Skills were administered. They are included herein as Appendices C and D, respectively. Each item of the test measures one of the first eighteen Cognition Enhancement Skills which are listed on page 6.

For use as an ability-control in conjunction with the application of the Analysis of Covariance technique, the Test of Cognitive Skills (TCS) was used. It is published as a part of the Comprehensive Test of Basic Skills by McGraw-Hill Company.

Statistical tests which were applied to the data were as follows:

1. The T-test, with matched pairs.
2. The Analysis of Covariance.
3. The Pearson Correlation.

The computations for the statistical tests of significance were carried out by a computer at the University of Washington. The actual data entries were made on a terminal for that computer, which is located in the administration building of the Bellevue School District. The statistical tests are a part of a program called Statistical Package for the Social Sciences (SPSS), which the university made available for this study.

The data which were analyzed during the application of the above tests are listed in the tables of Appendix E. The results of the statistical tests which were applied during this study are summarized in Appendices F, G, and H.

IV. The Summary and Analysis of the Data Which Were Obtained.

A. The correlation between TCS scores and scores on the Test of Cognition Enhancement Skills.

An examination of Appendix F shows the following:

1. In the case of three of the four groups of students, both post-test scores (after instruction had been received) and growth on both forms of the test had a correlation with the TCS scores that was statistically significant.

2. In the case of all four groups combined, the correlation between TCS scores and the pre-test scores was statistically significant.

B. Comparison of mean test scores, using the Analysis of Variance Technique (T-test).

An examination of Appendix G shows the following:

1. On the pre-tests, before any prior exposure to the Test of Cognition Enhancement Skills, all four groups scored higher on Form 2 than on Form 3. However, the difference was statistically significant in only two out of the four cases.

2. On post-tests taken after repeated administration of a specified form of the test, all four groups tended to score better on the respective test form that had been administered to them on multiple occasions than on the test form which had been administered only once or twice previously.

3. For all four groups, the test scores on the tests taken after receiving instruction were significantly higher than the test scores on the tests taken prior to receiving instruction. This was true for both forms of the Test of Cognition Enhancement Skills.

4. For both control groups, the difference between pre-test scores and post-test scores (without instruction having been received) were not statistically significant. This was true for both forms of the Test of Cognition Enhancement Skills.

C. Comparisons of the mean test scores of experimental and control groups, using the Analysis of Covariance.

An analysis of Appendices H-1 and H-2 indicates conflicting results in those two sections of the research project.

Appendix H-1 shows that there was not a statistically significant difference between the experimental group (Sheets) and the control group (Rudloff) at the end of the period in which the experimental group received instruction and the control group did not recieve instruction. However, it shows that there was a statistically significant difference between the two groups after both had received instruction. The indication is that the instruction involving sessions on successive school days resulted in better test scores than instruc-

tion which was spread out over a period of sixteen weeks.

On the other hand, Appendix H-2 shows that there was a statistically significant difference between the experimental group (Albertini) and the control group (Umbeck) at the end of the period in which the experimental group had received instruction but the control group had not. However, in this section of the project, it is indicated that there was not a statistically significant difference in test scores as a result of concentrated instruction as compared with spread-out instruction.

Perhaps this apparent contradiction in results can be explained in part by pointing out that the students in the class of teacher Sheets had much higher TCS ability-control scores than did the students in the class of teacher Rudloff. As a result, the adjusted means which were obtained for the experimental and control groups by the application of the Analysis of Covariance technique were not as different as were the unadjusted means. In other words, the students of teacher Sheets were so much higher in basic ability than were those of teacher Rudloff, that this factor had more influence on the outcome of the statistical test than did the factor of instruction.

D. A search for a plateau in student test scores.

In an effort to explore the question of whether the test scores of students reached a plateau by the end of the sixteen-session instructional period, Table 1 has been developed from the data of Appendix E. A graph of these data is presented in Figure 1.

The table has been developed by combining the scores of the two experimental classes into a single group and by combining the scores of the two control classes into a single group. The rationale for this combining is based on the assumption that Forms 2 and 3 of the Test of Cognnition Enhancement Skills are equivalent, as has been indicated by foregoing analyses.

The data in Table 1 and the graph in Figure 1 indicate that:

1. the two groups attained generally equivalent scores on the pre-test, prior to any instruction.

2. the experimental group attained a higher mean score after sixteen weeks of testing and instruction than did the control group after the same period of testing with no instruction.

3. after sixteen daily instructional sessions, the control group attained a mean score that was higher than the final mean score that the experimental group attained after sixteen weekly instructional sessions.

4. no significant plateau in test scores was reached by either group up to the end of sixteen instructional sessions.

5. considering only the form of the Test of Cognition Enhancement Skills which was administered only as a pre-test and post-test, students in all four groups had a mean score of 6.3 on the pre-test prior to instruction and a mean score of 8.9 on the post-test after instruction. They showed a mean gain of 2.6.

Table 1. Scores for Combined Groups

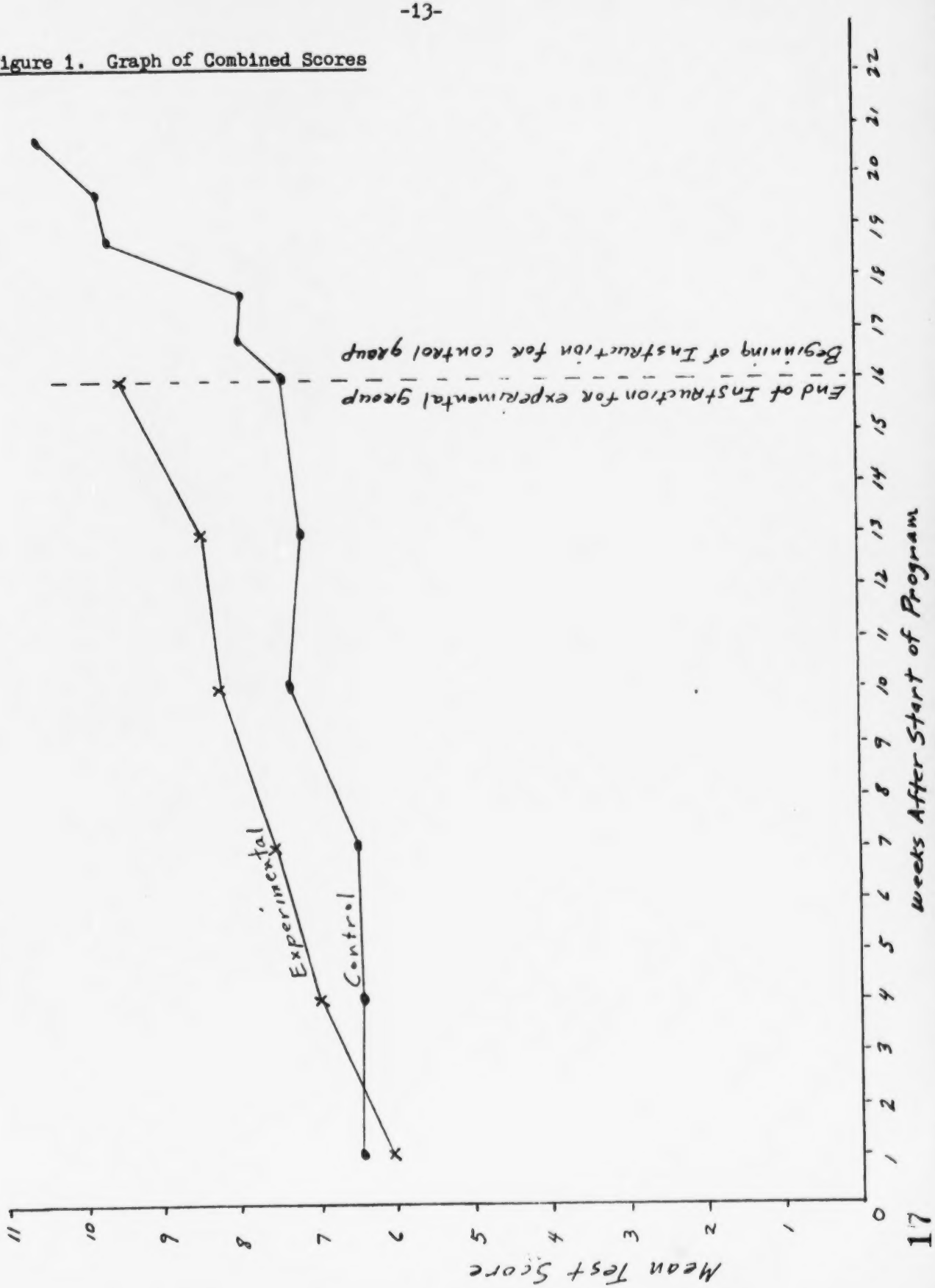
Table 1-a. Mean Test Scores For Combined Groups On The Test Form That Was Adminstered Repeatedly.

	Pre-test (Test 1)	Test 4	Test 7	Test 10	Test 13	Post-test (Test 16)	Test 4-B	Test 7-B	Test 10-B	Test 13-B	Post-test (Test 16-B)
Experimental Group (N= 37)	6.1	7.0	7.6	8.3	8.5	9.6					
Control Group (N=37)	6.4	6.4	6.5	7.4	7.2	7.4	7.9	7.8	9.6	9.7	10.5

Table 1-b. Mean Test Scores For Combined Groups On The Test Form That Was Administered Only As A Pre-test And Post-test.

	Pre-test	Post-test A	Post-test B
Experimental Group (N=37)	6.0	8.2	
Control Group (N=37)	6.6	6.2	9.5

Figure 1. Graph of Combined Scores



V. Conclusions.

A. Students who demonstrated a higher basic ability, as measured by the Test of Cognitive Skills (TCS), tended to score better on the Test of Cognition Enhancement Skills, whether it was the pre-test prior to instruction or post-test following instruction, than did students of lower ability. Also, they tended to demonstrate more growth on the test, from pre-test to post-test, than did students of lower ability.

B. Form 2 and Form 3 of the Test of Cognition Enhancement Skills were shown to be equivalent.

C. Multiple exposure to a specific form of the Test of Cognition Enhancement Skills, in and of itself, resulted in slightly elevated test scores.

D. Students who received sixteen instruction sessions in Cognition Enhancement attained post-test scores which were higher than those of students who received no instruction, and the difference was statistically significant.

E. As measured by the Test of Cognition Enhancement Skills, the growth of students in the Cognition Enhancement program did not reach a plateau within the span of sixteen instructional sessions.

F. Prior to instruction, students attained scores on the Test of Cognition Enhancement Skills which had a mean value of 6.3. On the post-test following instruction, the mean score was 8.9. Thus, they showed a gain of 2.6 from pre-test to post-test.

SUBSETS OF COGNITION ENHANCEMENT SKILLS

General Skills	Observable Skills (As observed in Cognition Enhancement sessions.)	Measurable Skills (As measured by the pre-test and post-test)
1. Is able to formulate a hypothesis which attempts to explain a specific phenomenon.	1. States hypotheses.	1a. From a list of hypotheses attempting to explain a specific phenomenon, selects the only one which could be reliable. (1,2)* 1b. Given a hypothesis, selects, from a list of data, the one item that warrants formulation of the hypothesis. (3)
2. Is able to gather data that verify conditions, objects, and other factors involved in a specific pnenomenon.	2. Asks verification questions.	2. From a set of questions, selects the one which best verifies a condition. (4)
3. Is able to conduct experiments which yield data related to a specific phenomenon.	3. Asks experimentation questions.	3a. From a set of questions, selects the one which corresponds most closely to conducting an experiment. (5) 3b. From a set of questions, selects the best re-wording of a given unacceptable experimentation question. (6)
4. When confronted by the need to know whether a specific factor is vital to the existence of a specific phenomenon, is able to gather data that lead to a conclusion in that regard.	4. Re-words synthesis or necessity questions into an acceptable form.	4 & 5. From a set of questions, identifies all which ask about the reliability of a hypothesis. (7)
5. Realizes that conclusions must be based on data rather than speculation.	5. Avoids synthesis and necessity questions.	
6. Is able to use data-gathering processes that focus on the specific type of data desired.	6. Words questions precisely.	6. From a set of questions on the same topic, selects the most precise wording as being the best wording. (8)
		(*The numbers listed at the end of each skill in this column refer to the test items which measure the respective skills.)

Appendix A-1

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7. Realizes that a specific factor which is present to a certain degree in one of a pair of phenomena being compared is not necessarily significant unless that same factor is present to a <u>different</u> degree in the other one of the pair.	7. Asks control questions.	7. From a list of possible next questions, selects the control question as being the logical next question. (9)
8. Is able to build upon data already gathered.	8. Asks sequential series of questions.	8a. From a set of questions, selects the one which should be asked first in a series. (10) 8b. Arranges a given set of questions in the order in which it would be best to ask them. (17)
9, 10, & 11. Is able to use data previously gathered by self or others, in order to either formulate hypotheses or gather additional data.	9. Uses data gathered by self as a basis for unique hypotheses. 10. Builds on data gathered by other students. 11. Uses data gathered by others as a basis for unique hypotheses.	9, 10, & 11. Given a set of data, selects from a list of hypotheses the one hypothesis which best fits the set of data. (14, 15)
12. Is able to formulate a hypothesis in such a manner that it fits all of the data.	12. States hypotheses precisely.	12. From a list of possible hypotheses, selects the most precise hypothesis. (15)
13. Is able to identify data that confirm hypotheses.	13. Points out data that confirm hypotheses.	13a. From a list of data, selects the item of data that best leads to a hypothesis. (3) 13b. From a list of data, selects the item of data that does not support a given hypothesis. (11)
14. Is able to identify data that show a hypothesis to be unreliable.	14. Points out data that invalidate hypotheses.	14 & 15. Given a hypothesis, identifies, from a list of data, those which indicate the hypothesis to be unreliable. (12, 13)
15. Is willing to reject own hypothesis when valid data indicate that it is unreliable.	15. Rejects own hypotheses when invalidating evidence is apparent.	

16. Is able to realize the need for changes in hypotheses when new data warrant them, and is able to modify the hypotheses accordingly.	16. Suggests changes in hypotheses on the basis of new data that have been gathered.	16. Given a set of new data, selects, from a list of hypotheses, the modified hypothesis which best reflects the new data. (16)
17. Is able to identify a hypothesis as not having been tested adequately.	17. Points out untested hypotheses.	17. Given a set of data, selects, from a list of hypotheses, the hypothesis which is not tested by the data. (18)
18. Is able to recognize and value more specific hypotheses, as opposed to less specific hypotheses.	18. Points out and values greater specificity levels among hypotheses.	18. From a list of reliable hypotheses, selects the most specific hypothesis fitting a given set of data. (15)
19. Is able to gather data under a variety of conditions and in a variety of ways.	19. Tests hypotheses by gathering data independently.	(There is no test item corresponding to this observable skill.)

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THE SCHEDULE FOR LEVEL IX

(Newport Hills Elementary School)
(Part 1)

Groups(s) Involved	Week	Date	Topic
A & B	1	1/7	Brief introduction to program.
A & B		1/8	Test of Cognitive Skills (TCS) (Ability-control).
A & B		1/9	Focus: The bubbly liquid (science).
A & B		1/10	Pre-test 1, Form 2.
A & B		1/11	Pre-test 2, Form 3.
A	2	1/17	Explanation of Cognition Enhancement Skills as they can be exhibited in conjunction with the bubbly liquid focus.
A	3	1/24	Focus: The floating cap (science).
A	4	1/31	Focus: Monthly fluctuations in watermelon prices (social st.).
A & B		2/6	Interim Test #1, Form 2.
A	5	2/7	Focus: The glowing lamp (science).
A	6	2/14	Focus: The radiating lines (social studies).
A	7	2/21	Focus: Faucet washers (everyday problems).
A & B		2/27	Interim Test #2, Form 2.
A	8	2/28	Focus: Why a small town looks that way (social studies).
A	9	3/7	Explanation of the logic involved in test Form 1.
A	10	3/14	Focus: Math rule (mathematics).
A & B		3/20	Interim Test #3, Form 2.
A	11	3/21	Focus: 25 mph and 30 mph traffic signs (social studies).
A	12	3/28	Focus: The thermostat (everyday problems).
A	13	4/4	Focus: The green barrels (social studies).
A & B		4/17	Interim Test # 4, Form 2.
A	14	4/18	Focus: The diving vial (science).
A	15	4/25	Explanation of the Cognition Enhancement Skills as they can be exhibited in conjunction with the Diving Vial focus.
A	16	5/2	Focus: The shrinking potato (science).
A & B		5/8	Post-test #1-A, Form 2.
A & B		5/9	Post-test #2-A, Form 3.

All instructional sessions are scheduled for 45 minutes.
Group A is the class of teacher Joe Sheets.
Group B is the class of teacher Pat Rudloff.
All tests are scheduled for one hour.

THE SCHEDULE FOR LEVEL IX

(Newport Hills Elementary School)
(Part 2)
(Pat Rudloff's Class)

Date	Session Number	Topic of Session
5/13	2	Explanation of Cognition Enhancement Skills as they can be exhibited in conjunction with the bubbly liquid focus.
5/14	3	Focus: The floating cap (science).
5/15	4	Focus: Monthly fluctuations in watermelon prices (social studies).
5/17	T-4	Interim Test #4, Form 2.
5/20	5	Focus: The glowing lamp (science).
5/21	6	Focus: The radiating lines (social studies).
5/22	7	Focus: Faucet washers (everyday problems).
5/23	T-7	Interim Test #7, Form 2.
5/24	8	Focus: Why a small town looks that way (social studies).
5/28	9	Explanation of the logic involved in test Form 1.
5/29	10	Focus: Math rule (mathematics).
5/30	T-10	Interim Test #10, Form 2.
6/3	11	Focus: 25 mph and 30 mph traffic signs (social studies).
6/4	12	Focus: The thermostat (everyday problems).
6/5	13	Focus: The green barrels (social studies).
6/6	T-13	Interim Test # 13, Form 2.
6/7	14	Focus: The diving vial (science).
6/10	15	Explanation of the Cognition Enhancement Skills as they can be exhibited in conjunction with the Diving Vial focus.
6/11	16	Focus: The shrinking potato (science).
6/14	PT-1	Post-test 1-B, Form 2.
6/17	PT-2	Post-test 2-B, Form 3.

THE SCHEDULE FOR LEVEL IX

(Somerset Elementary School)
(Part 1)

Groups Involved*	Week	Date	Topic
A & B	1	1/14	Brief introduction to the program.
A & B		1/15	Test of Cognitive Skills (TCS) (Ability-control).
A & B		1/16	Focus: The shrinking potato (science).
A & B		1/17	Pre-test 1, Form 3.
A & B		1/18	Pre-test 2, Form 2.
A	2	1/22	Explanation of Cognition Enhancement Skills as they can be exhibited in conjunction with the Shrinking Potato focus.
A	3	1/29	Focus: The floating cap (science).
A	4	2/5	Focus: Monthly fluctuations in watermelon prices (social st.).
A & B		2/8	Interim Test #1, Form 3.
A	5	2/12	Focus: The glowing lamp (science).
A	6	2/19	Focus: The radiating lines (social studies).
A	7	2/26	Focus: Faucet washers (everyday problems).
A & B		3/1	Interim Test #2, Form 3.
A	8	3/5	Focus: Why a small town looks that way (social studies).
A	9	3/12	Explanation of the logic involved in test Form 1.
A	10	3/19	Focus: Math rule (mathematics).
A & B		3/22	Interim Test #3, Form 3.
A	11	3/26	Focus: 25 mph and 30 mph traffic signs (social studies).
A	12	4/2	Focus: The thermostat (everyday problems).
A	13	4/16	Focus: The green barrels (social studies).
A & B		4/19	Interim Test #4, Form 3.
A	14	4/23	Focus: The diving vial (science).
A	15	4/30	Explanation of the Cognition Enhancement Skills as they can be exhibited in conjunction with the Diving Vial focus.
A	16	5/7	Focus: The bubbly liquid (science).
A & B		5/8	Post-test 1-A, Form 3.
A & B		5/9	Post-test 2-A, Form 2.

All instructional sessions are scheduled for 45 minutes.
All test sessions are scheduled for one hour.
Group A is the class of teacher Geri Albertini.
Group B is the class of teacher Jim Umbeck.

THE SCHEDULE FOR LEVEL IX

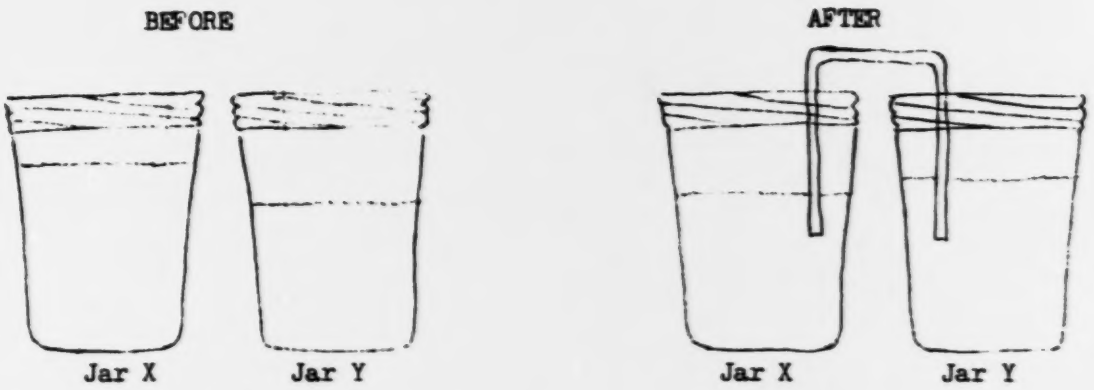
(Somerset Elementary School)
(Part 2)
(Jim Umbeck's Class)

Date	Session Number	Topic of Session
5/13	2	Explanation of Cognition Enhancement Skills as they can be exhibited in conjunction with the Shrinking Potato focus.
5/14	3	Focus: The floating cap (science).
5/15	4	Focus: Monthly fluctuations in watermelon prices (social studies).
5/16	T-4	Interim Test 4, Form 3.
5/17	5	Focus: The glowing lamp (science).
5/20	6	Focus: The radiating lines (social studies).
5/21	7	Focus: Faucet washers (everyday problems).
5/22	T-7	Interim Test 7, Form 3.
5/24	8	Focus: Why a small town looks that way (social studies).
5/28	9	Explanation of the logic involved in test Form 1.
5/29	10	Focus: Math rule (mathematics).
5/30	T-10	Interim Test 10, Form 3.
6/3	11	Focus: 25 mph and 30 mph traffic signs (social studies).
6/4	12	Focus: The thermostat (everyday problems).
6/5	13	Focus: The green barrels (social studies).
6/6	T-13	Interim Test 13, Form 3.
6/7	14	Focus: The diving vial (science).
6/10	15	Explanation of the Cognition Enhancement Skills as they can be exhibited in conjunction with the Diving Vial focus.
6/11	16	Focus: The bubbly liquid (science).
6/12	PT-1	Post-test 1-B, Form 3.
6/14	PT-2	Post-test 2-B, Form 2.

FORM 2

TEST ON COGNITION ENHANCEMENT SKILLS

The questions on this test are all aimed at the focus which is pictured below and described below.



Description of focus

Before the U-tube is inserted into the two jars, the level of the liquid in jar X is about 1-inch higher than the level of the liquid in jar Y. Within 5 minutes after the U-tube has been inserted, the level of the liquid in jar X is about 1/8-inch below the level of the liquid in jar Y.

Focus question

Why does the level of the liquid in jar X become lower than the level of the liquid in jar Y?

- -

1. Without further data, which of the following hypotheses could be reliable?
   A. Because liquid X travels through the U-tube more easily than liquid Y does.
   B. Because liquid X is warm.
   C. (Both hypotheses A and B, above.)
   D. (Neither hypothesis A or B, above.)

2. Without any further data, which of the following could not be an acceptable hypothesis?
   A. Because there is oil in liquid Y.
   B. Because there is salt in liquid X.
   C. (Both hypothesis A and hypothesis B, above, are not acceptable.)

3. Which question, by itself, could best help you to form a hypothesis if its answer were "yes"?
   A. Is liquid X cold at the start?
   B. Is there more sugar in liquid X than in liquid Y at the start?
   C. Is there any vinegar in either jar X or jar Y at the start?
   D. Is there any salt in jar Y?

4. Which one of the following questions, if answered "yes", would give you the most important data?
   A. Is there more oil in liquid Y than in liquid X at the start?
   B. Is liquid X cold at the start?
   C. Is there any sugar in either liquid X or liquid Y at the start?
   D. Is there any salt in liquid X?

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5. Which one of the following questions could best be answered by performing a single experiment?

   A. Is liquid Y thick?
   B. If there is sugar in liquid Y, is it table sugar?
   C. Would the liquid levels change if there were no liquid in the U-tube?
   D. Is there baking soda in either liquid X or liquid Y?

6. Suppose you asked the following question: "What would happen if you heated liquid Y 10 degrees higher before inserting the U-tube?" The most acceptable way to re-word it would be:

   A. If you heated liquid Y 10 degrees higher before inserting the U-tube, would the level of the liquid in jar X end up to be higher than the level of the liquid in jar Y?
   B. If you heated liquid Y 10 degrees higher before inserting the U-tube, what would happen?
   C. If you heated liquid Y 10 degrees higher before inserting the U-tube, would the same thing happen?

7. Which of the following questions has the hidden meaning of asking whether a hypothesis is reliable?

   A. What is in liquid X at the start?
   B. Is liquid X colder than liquid Y at the start?
   C. Does the liquid in jar Y end up to be higher because liquid Y is warmer at the start?
   D. (All three of the above questions - A, B, and C.)

8. Which one of the following questions is best?

   A. Is there any oil in the liquid at the start?
   B. Is there any oil in liquid Y at the start?
   C. Is there anything in liquid Y at the start?
   D. Is there any oil in Y?

9. Suppose you had just asked the following question as your first question asked, and had been given the answer indicated in parentheses: "Is there any oil in jar Y at the start? (yes)" Which of the following questions would be best to ask next?

   A. Is there more oil in jar Y than in jar X at the start?
   B. Is there any oil in jar X at the start?
   C. Is there anything else in jar Y at the start?
   D. Is there more than one tablespoonful of oil in jar Y at the start?

10. Which of the following questions should be asked first?

    A. Is there more salt in jar X than in jar Y at the start? (no)
    B. Is there any salt in jar X at the start? (yes)
    C. Is there anything besides tapwater in jar X at the start? (yes)

11. Suppose that you are considering the following hypothesis: "Because liquid Y contains more alcohol at the start than liquid X does." Which one of the following questions, with its answer, does not support or confirm that hypothesis?

    A. Is there more alcohol in liquid Y than in liquid X at the start? (yes)
    B. Is there any alcohol in liquid Y at the start? (yes)
    C. Is there any alcohol in liquid X at the start? (yes)
    D. If you took all of the alcohol out of liquid Y at the start, would the liquid level still end up higher in jar Y? (no)

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12. Suppose that you are considering the following hypothesis: "Because the total amount of oil and alcohol in liquid Y is greater than the total amount of oil and alcohol in liquid X." Which one of the following questions, with its answer, indicates that this hypothesis is unreliable?
    A. Is there any alcohol in liquid X at the start? (yes)
    B. Is there any oil in liquid Y at the start? (yes)
    C. Is there any alcohol in liquid Y at the start? (yes)
    D. Is there any oil in liquid X at the start? (yes)
    E. (None of the questions A, B, C, or D, above.)

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13. Suppose that you are considering the following hypothesis: "Because there is more alcohol in jar Y at the start than in jar X at the start." Which of the following questions, with its answer, indicates that this hypothesis is unreliable?
    A. Is there any alcohol in jar X at the start? (no)
    B. Is there any gasoline in jar Y at the start? (yes)
    C. Is there any alcohol in jar Y at the start?(no)
    D. If you switched the liquids at the start, would the liquid in jar X end up being higher than the liquid in jar Y? (yes)
    E. (All of questions A, B, C, and D, above.)

14. Suppose that the following questions had been asked about the focus, in the order given:
    Is there any alcohol in liquid X at the start? (no)
    Is there any oil in liquid X at the start? (yes)
    Is there any water in liquid Y at the start? (no)
    If you switched the liquids at the start, would the level of the liquid in jar X end up higher than the level of the liquid in jar Y? (yes)
    Is there any alcohol in jar Y at the start? (yes)
    Is there any salt in jar X at the start? (no)
    Is there any oil in liquid Y at the start? (yes)

    Now, considering the answers to all of the above questions, which of the following hypotheses is most reliable?
    A. Because there is more salt in liquid X at the start than in liquid Y at the start.
    B. Because liquid Y is warmer at the start than liquid X is at the start.
    C. Because there is more alcohol in liquid Y at the start than in liquid X at the start.
    D. Because there is more oil in liquid Y at the start than in liquid X at the start.

15. Suppose that the following questions have been asked, in the order listed:
    Is there something in liquid Y at the start that is not in liquid X at the start? (yes)

    Is there any oil in liquid Y at the start? (yes)

    Is the oil in liquid Y mineral oil? (yes)
    Is there any oil in liquid X at the start? (no)

    Then which one of the following hypotheses would be the best one?
    A. Because there is mineral oil in Y, but not in X.
    B. Because there is oil in liquid Y at the start, but not in liquid X at the start.
    C. Because there is something in liquid Y at the start that is not in liquid X at the start.
    D. Because there is mineral oil in liquid Y at the start, but not in liquid X at the start.

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16. Suppose you are considering the following hypothesis: "Because there is something in liquid X at the start that is not in liquid Y at the start."

Then suppose the following questions were asked:

Is liquid X warm at the start? (yes)
Is there any water in liquid X at the start? (yes)
Is there any alcohol in liquid X at the start? (yes)
Is there any salt in liquid X at the start? (yes)
Is there any water in liquid Y at the start? (yes)
Is there any alcohol in liquid Y at the start? (yes)
Is there any salt in liquid Y at the start? (no)

Now, because of the answers to these questions, how would you change the original hypothesis?

A. Because there is salt in liquid X at the start, but not in liquid Y.
B. Because liquid X is warm at the start, but liquid Y isn't.
C. Because liquid X contains water, alcohol, and salt at the start.
D. Because liquid X is warm at the start, and it contains water, alcohol, and salt.

17. Read <u>all</u> of the questions. Then decide which is the best order for them to be asked if you were going to ask a series of questions. First select the letter of the question you would ask first, then the letter of the one you would ask second, and so on, until you have selected all of the letters. Whenever you are considering two questions whose only difference is X or Y, select the X question just before the corresponding Y question.

P. Is the amount of salt in liquid X at the start the same as in liquid Y? (no)
Q. Is there any tapwater in liquid X at the start? (yes)
R. Is there anything besides tapwater in liquid X at the start? (yes)
S. Is there any salt in liquid Y at the start? (yes)
T. Is there more salt in liquid Y at the start than in liquid X? (yes)
U. Is there any tapwater in liquid Y at the start? (yes)
V. Is there anything besides tapwater in liquid Y at the start? (yes)
W. Is there any salt in liquid X at the start? (yes)

Now, select the <u>best</u> order from the possibilities listed below.

A. QURVWSTP
B. QURVWSPT
C. QUWSRVPT
D. RVQUWSPT
E. RVQUWSTP

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18. Suppose the following questions were asked:

Is there any salt in liquid X at the start? (yes)
Is liquid Y warm at the start? (no)
If the liquids were switched in the jars at the start, would the level of the liquid in jar X end up being higher than the level of the liquid in jar Y? (yes)
Is there any alcohol in liquid Y at the start? (no)
Is liquid X warm at the start? (yes)
Is there any salt in liquid Y at the start? (yes)
Is the amount of salt in liquids X and Y the same at the start? (no)
Are the temperatures of liquid X and liquid Y the same at the start? (yes)

Then decide which of the following hypotheses is <u>not</u> tested by the series of questions enough to tell whether it is reliable or unreliable.

A. Because jar X is different from jar Y.
B. Because there is more salt in liquid X at the start than in liquid Y.
C. Because liquid Y is warmer at the start than is liquid X.
D. Because there is alcohol in liquid Y at the start, but not in liquid X.
E. (All of the above: A,B, C, and D are not tested enough.)

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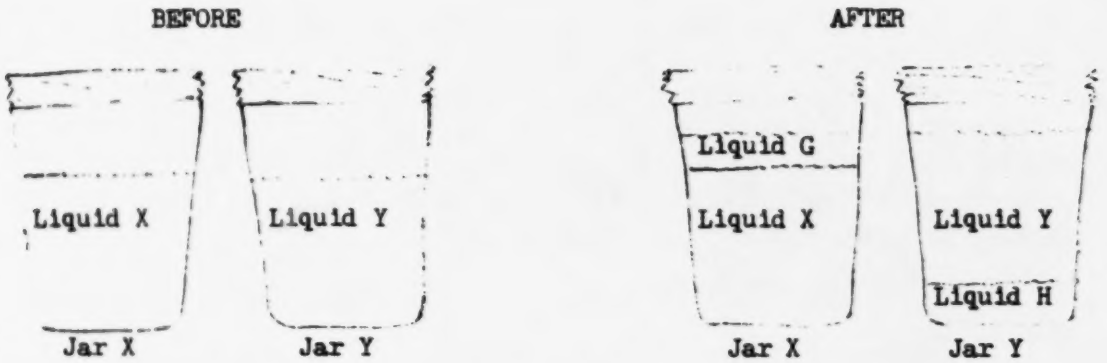
FORM 3

TEST ON COGNITION ENHANCEMENT SKILLS

The questions on this test are all aimed at the focus which is pictured below and described below.



Description of focus

Jar X and Jar Y both contain colorless liquids. Some of liquid G, a green liquid, is placed into jar X, and it floats over liquid X. Some of liquid H, a red liquid, is placed into jar Y, and it sinks below liquid Y.

Focus question

Why does liquid G float and liquid H sink?

- -

1. Without further data, which of the following hypotheses could be reliable?
   A. Because liquid H is heavier than liquid G.
   B. Because liquid X is thick.
   C. (Both hypothesis A and hypothesis B, above.)
   D. (Neither hypothesis A nor hypothesis B, above.)

2. Without further data, which of the following could not be an acceptable hypothesis?
   A. Because liquid G is oil.
   B. Because liquid H contains salt, but liquid G doesn't.
   C. (Both hypothesis A and hypothesis B, above, are not acceptable.)

3. Which question, by itself, could best help you to form a hypothesis if its answer were "yes"?
   A. Is there any oil in either liquid X or liquid Y?
   B. Is there any sugar in jar X?
   C. Is liquid X thick?
   D. Is there more salt in liquid H than in liquid G?

4. Which one of the following questions, if answered "yes", would give you the most important data?
   A. Is there any baking soda in liquid X?
   B. Is there any water in either liquid X or liquid Y?
   C. Is there more salt in liquid X than in liquid Y?
   D. Is liquid Y warm?

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5. Which one of the following questions could best be answered by performing a single experiment?
   A. Would liquid G be floating if it had the same weight as liquid H?
   B. If liquid Y is warm, is it warmer than liquid X?
   C. Is there any oil in liquid Y?
   D. Is liquid X tapwater?

6. Suppose you asked the following question: "What would happen if you took all of the salt out of liquid X?" The most acceptable way to re-word it would be?
   A. If you took all of the salt out of liquid X, would liquid G still float in it?
   B. If you took all of the salt out of liquid X, would it be exactly the same as liquid Y?
   C. If you took all of the salt out of liquid X, what would happen?

7. Which of the following questions has the hidden meaning of asking whether a hypothesis is reliable?
   A. Does it have anything to do with the weight of liquid H?
   B. What is liquid H?
   C. Is liquid H heavier than liquid G?
   D. (All three of the above questions - A,B, and C.)

8. Which one of the following questions is best?
   A. Is there anything in liquid X?
   B. Is there any salt in liquid X?
   C. Is there any salt in X?
   D. Is there anything in X?

9. Suppose you had just asked the following question as your first question asked, and had been given the answer indicated in parentheses: "Is there any salt in liquid H?" (yes). Which of the following questions would be best to ask next?
   A. Is there anything else in liquid H besides salt?
   B. Is there any salt in liquid Y?
   C. Is there more salt in liquid H than in liquid G?
   D. Is there any salt in liquid G?

10. Which of the following questions should be asked first?
   A. Is there more sugar in liquid X than in liquid Y? (yes)
   B. Is there any sugar in liquid X? (yes)
   C. Is there anything besides sugar in liquid X? (yes)

11. Suppose that you are considering the following hypothesis: "Because liquid X contains more sugar than liquid Y." Which one of the following questions, with its answer, <u>does not support or confirm</u> that hypothesis?
   A. Is there any sugar in liquid X? (yes)
   B. If you took all of the sugar out of liquid X, would liquid G float in it? (no)
   C. Is there more sugar in liquid X than in liquid Y? (yes)
   D. Is there any sugar in liquid Y? (yes)

12. Suppose that you are considering the following hypothesis: "Because the total amount of sugar and salt in liquid X is greater than the total amount of sugar and salt in liquid Y." Which of the following questions, with its answer, indicates that this hypothesis is unreliable?
   A. Is there any sugar in liquid X? (no)
   B. Is there any sugar in liquid Y? (no)
   C. Is there any salt in liquid Y? (yes)
   D. Is there any salt in liquid X? (yes)

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13. Suppose that you are considering the following hypothesis: "Because there is more sugar in liquid H than in liquid G." Which of the following questions, with its answer, indicates that this hypothesis is unreliable?
    A. Is there any sugar in liquid G? (yes)
    B. Is there any sugar in liquid H? (yes)
    C. Is there any tapwater in liquid H? (yes)
    D. If you took all of the sugar out of liquid H, would it still sink in liquid Y? (yes)
    E. (All of questions A,B,C, and D, above.)

14. Suppose that the following questions had been asked about the focus, in the order given:

    1. Does liquid Y contain oil? (yes)
    2. Does liquid X contain sugar? (yes)
    3. Does liquid X contain oil? (no)
    4. Does liquid G contain tapwater? (yes)
    5. Does liquid H contain tapwater? (no)

    Now, considering the answers to all of the above questions, which of the following hypotheses is most reliable?

    A. Because liquid X contains sugar, but liquid Y doesn't.
    B. Because liquid H is heavier than liquid G.
    C. Because liquid Y contains oil, but liquid X doesn't.
    D. Because liquid Y contains more alcohol than liquid X does.

15. Suppose that the following questions have been asked, in the order listed:

    1. Is there anything in liquid X besides tapwater? (yes)
    2. Is there any sugar in liquid X? (yes)
    3. Is there sugar in liquid Y? (no)
    4. Is the sugar in liquid X table sugar? (yes)

    Then, which one of the following hypotheses would be the best one?

    A. Because there is table sugar in liquid X, but not in liquid Y.
    B. Because there is something in liquid X that is not in liquid Y.
    C. Because there is sugar in X, but not in Y.
    D. Because liquid X contains table sugar.

16. Suppose you are considering the following hypothesis: "Because there is more salt in liquid H than in liquid G."

    Then, suppose the following questions were asked:

    1. Is there any salt in liquid H? (yes)
    2. Is there any salt in liquid G? (yes)
    3. Is there more salt in liquid H than in liquid G? (no)
    4. Is there any sugar in liquid H? (yes)
    5. Is there any sugar in liquid G? (no)
    6. Is liquid G thick? (no)
    7. Is liquid H heavy? (yes)
    8. If you took all of the salt out of liquid H, would it still sink in liquid Y? (no)

    Now, because of the answers to these questions, how would you change the original hypothesis?
    A. Because liquid H is heavier than liquid G.
    B. Because liquid H is thicker than liquid G.
    C. Because there is more sugar in liquid H than in liquid G.
    D. Because there is more total sugar and salt in liquid H than in liquid G.

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17. Read all of the questions. Then decide which is the best order for them to be asked if you were going to ask a series of questions. First select the letter of the question you would ask first, then the letter of the one you would ask second, and so on, until you have selected all of the letters. Whenever you are considering two questions whose only difference is liquid X or liquid Y, select the liquid X question just before the corresponding liquid Y question.

P. Is there any tapwater in liquid X? (yes)
Q. Is there anything besides tapwater in liquid X? (yes)
R. Is there any salt in liquid Y? (yes)
S. Is there more salt in liquid Y than in liquid X? (yes)
T. Is there any tapwater in liquid Y? (yes)
U. Is there anything besides tapwater in liquid Y? (yes)
V. Is there any salt in liquid X? (yes)
W. Is the amount of salt in liquid X and liquid Y the same? (no)

Now, select the <u>best</u> order from the possibilities listed below.

A. PTQUVRSW
B. QUVRPTWS
C. PTQUVRWS
D. VRPTQUSW
E. QTPUVRWS

18. Suppose the follwing questions were asked:

1. Is there any salt in liquid H? (no)
2. Is there any oil in liquid Y? (yes)
3. Is there any oil in liquid X? (yes)
4. Is the amount of oil in liquid X and liquid Y the same? (no)
5. Is there any sugar in liquid X? (yes)
6. If you placed one ounce of liquid G into liquid Y, would it sink? (yes)
7. Is there more oil in liquid Y than in liquid X? (yes)

Then, decide which of the following hypotheses is <u>not</u> tested by the series of questions enough to tell whether it is reliable or unreliable.

A. Because there is more oil in liquid Y than in liquid X.
B. Because liquid H is heavier than liquid G.
C. Because there is more sugar in liquid X than in liquid Y.
D. Because there is more salt in liquid H than in liquid G.
E. (All of the above: A,B,C, and D are not tested enough.)

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DATA FROM THE 1984-85 RESEARCH PROJECT : Teacher Sheets, Experimental Group 1.

Student Number	TCS Total	Pre-test 1 Form 2	Pre-test 2 Form 3	Test 4 Form 2	Test 7 Form 2	Test 10 Form 2	Test 13 Form 2	Post-test 1-A, Form 2	Post-test 2-A, Form 3	Test 4-B Form 2	Test 7-B Form 2	Test 10-B Form 2	Test 13-B Form 2	Post-test 1-B, Form 2	Post-test 2-B, Form 3	Growth Form 2	Growth Form 3
1	683	9	11	13	10	13	13	15	12							6	1
2	616	7	6	6	8	7	7	9	6							2	0
3	647	7	8	9	11	8	7	8	9							1	1
4	738	5	3	6	10	8	8	9	7							4	4
5	507	6	3	3	6	3	5	9	4							3	1
6	623	9	3	6	5	6	5	7	5							-2	2
7	709	8	8	10	11	11	10	11	12							3	4
8	565	7	6	4	3	6	5	6	3							-1	-3
9	632	5	4	11	11	8	10	10	8							5	4
10	557	5	1	4	7	6	3	5	3							0	2
11	647	7	4	6	4	2	4	4	7							-3	3
12	497	4	4	4	5	6	6	3	4							-1	0
13	673	10	5	8	13	12	11	12	10							2	2
14	630	5	6	7	5	8	13	11	8							6	2
15	638	9	5	9	8	8	9	13	7							4	-2
16	600	5	2	2	4	5	7	5	5							0	0
17	554	5	4	6	3	6	6	7	4							2	-1
18	745	6	10	8	11	11	10	14	12							8	6
19	610	8	8	8	9	9	11	11	13							3	5

DATA FROM THE 1984-85 RESEARCH PROJECT: Teacher Rudloff, Control Group 1

Student Number	TCS Total	Pre-test 1 Form 2	Pre-test 2 Form 3	Test 4 Form 2	Test 7 Form 2	Test 10 Form 2	Test 13 Form 2	Post-test 1-A, Form 2	Post-test 2-A, Form 3	Test 4-B Form 2	Test 7-B Form 2	Test 10-B Form 2	Test 13-B Form 2	Post-test 1-B, Form 2	Post-test 2-B, Form 3	Growth Form 2	Growth Form 3
20	401	3	7	5	7	8	7	8	1	7	7	4	6	3	6	0	-1
21	574	6	6	6	7	6	4	7	5	7	10	11	11	14	12	8	6
22	574	6	7	6	6	6	9	7	8	5	6	8	9	11	10	5	3
23	694	5	8	6	4	10	7	6	11	10	13	14	12	12	8	7	0
24	488	2	3	6	7	5	6	7	2	6	8	5	7	6	2	4	-1
25	498	9	3	3	5	7	3	5	5	7	6	2	7	3	5	-6	2
26	573	5	6	8	6	6	8	7	5	9	12	13	14	13	11	7	5
27	681	5	4	6	8	11	8	10	10	9	11	14	15	16	13	11	9
28	448	4	7	6	4	6	6	2	3	5	2	8	6	6	5	2	-2
29	682	8	7	7	7	9	7	8	11	10	9	8	11	13	12	5	5
30	548	8	4	7	8	5	7	7	6	8	3	7	7	7	7	-1	3
31	600	6	7	8	4	8	6	7	5	7	8	14	16	13	13	7	6
32	701	11	7	7	7	12	9	7	11	10	9	13	13	15	15	4	8
33	582	3	6	5	5	8	4	7	4	7	8	11	10	12	7	9	1
34	604	4	2	6	5	7	3	10	4	7	7	9	4	7	7	3	5
35	665	9	2	8	6	5	5	4	4	6	7	12	12	12	9	3	7
36	416	7	6	7	5	5	4	4	3	8	7	5	4	5	4	-2	-2
37	628	10	10	15	12	12	12	12	9	12	11	12	13	13	11	3	1

DATA FROM THE 1984-85 RESEARCH PROJECT: Teacher Albertini, Experimental Group 2.

Student Number	TCS Total	Pre-test 1 Form 3	Pre-test 2 Form 2	Test 4 Form 3	Test 7 Form 3	Test 10 Form 3	Test 13 Form 3	Post-test 1-A, Form 3	Post-test 2-A, Form 2	Test 4-B Form 3	Test 7-B Form 3	Test 10-B Form 3	Test 13-B Form 3	Post-test 1-B, Form 3	Post-test 2-B, Form 2	Growth Form 2	Growth Form 3
38	658	5	9	9	12	15	11	13	13							4	8
39	595	3	6	5	6	9	8	11	9							6	8
40	692	8	10	7	7	6	7	6	4							-6	-2
41	729	9	10	8	13	8	10	12	7							-3	3
42	641	7	8	4	5	10	12	10	12							4	3
43	526	4	6	6	2	6	5	6	6							0	2
44	607	8	8	7	7	9	9	11	12							4	3
45	655	4	3	4	6	11	12	11	10							7	7
46	704	6	9	10	7	12	10	11	9							0	5
47	614	3	4	5	6	12	13	9	7							3	6
48	690	4	8	10	8	7	10	10	10							2	6
49	664	7	3	7	8	12	7	11	14							11	4
50	632	4	7	4	9	6	10	12	8							1	8
51	649	5	9	8	6	9	7	12	9							0	7
52	722	5	5	8	12	11	9	11	10							5	6
53	545	5	3	7	6	2	4	7	7							4	2
54	650	4	11	10	11	9	11	11	9							-2	7
55	573	6	3	9	5	9	11	11	9							6	5

DATA FROM THE 1984-85 RESEARCH PROJECT: Teacher Umbeck, Control Group 2.

Student Number	TOS Total	Pre-test 1 Form 3	Pre-test 2 Form 2	Test 4 Form 3	Test 7 Form 3	Test 10 Form 3	Test 13 Form 3	Post-test 1-A, Form 3	Post-test 2-A, Form 2	Test 4-B Form 3	Test 7-B Form 3	Test 10-B Form 3	Test 13-B Form 3	Post-test 1-B, Form 3	Post-test 2-B, Form 2	Growth Form 2	Growth Form 3
56	637	7	4	4	7	9	8	7	3	7	6	7	14	12	9	5	5
57	726	8	8	3	10	6	8	10	13	12	11	13	11	13	13	5	5
58	682	4	6	8	5	9	7	7	6	3	9	13	12	16	14	8	12
59	676	5	6	6	4	11	4	3	4	2	4	10	4	8	6	0	3
60	609	7	7	8	9	10	6	9	7	8	9	7	7	11	11	4	4
61	644	5	10	6	8	7	4	8	7	9	8	13	11	15	13	3	10
62	592	6	7	6	5	8	5	6	6	6	6	6	8	8	3	-4	2
63	626	5	10	6	4	3	12	11	4	13	4	9	8	10	10	0	5
64	673	10	11	8	12	10	13	10	12	11	12	13	16	18	18	7	8
65	666	6	4	10	5	5	9	3	4	6	8	10	6	10	7	3	4
66	724	10	9	6	10	11	10	10	9	11	8	11	10	11	14	5	1
67	656	8	7	2	5	7	9	6	3	7	7	9	8	11	8	1	3
68	639	4	6	6	6	4	3	6	6	6	4	10	14	11	12	6	7
69	579	8	8	7	6	7	12	11	8	7	9	9	11	10	9	1	2
70	637	10	3	6	7	9	10	12	6	10	7	13	11	14	13	10	4
71	564	5	8	7	7	7	6	8	4	7	7	7	6	9	8	0	4
72	452	4	7	3	4	5	7	4	4	7	6	4	5	2	6	-1	-2
73	704	5	11	6	9	6	11	10	9	12	9	10	9	8	10	-1	3
74	596	10	11	7	4	3	6	8	7	8	9	10	11	11	12	1	1

Appendix F

PROBABILITY LEVELS FOR THE PEARSON CORRELATION BETWEEN TCS SCORES AND VARIOUS APPLICATIONS OF THE TEST OF COGNITION ENHANCEMENT SKILLS.

Teacher/Group	Pre-test 1	Pre-test 2	Post-test A Form 2	Post-test A Form 3	Post-test B Form 2	Post-test B Form 3	Growth Form 2	Growth Form 3	
Sheets			.002	.001			.015	.005	
Rudloff					.001	.001	.006	.001	
Albertini			.263	.039			.158	.383	
Umbeck					.018	.004	.033	.027	
All 4 groups	.003	.004							

(Probability levels of .050 or less are considered to be statistically significant.)

SUMMARY OF 1984-85 STATISTICAL TESTS

T-test (Analysis of Variance)

Teacher	Number of Students	Test	Form	Mean	Probability	Remarks
Sheets	19	PR-1	2	6.6842	.029	
Sheets	19	PR-2	3	5.3158		
Sheets	19	PR-1	2	6.6842	.004	Instruction
Sheets	19	PO-1	2	8.8947		
Sheets	19	PR-2	3	5.3158	.000	Instruction
Sheets	19	PO-2	3	7.3158		
Rudloff	18	PR-1	2	6.1667	.507	
Rudloff	18	PR-2	3	5.6667		
Rudloff	18	PR-1	2	6.1667	.348	No instruction
Rudloff	18	PO-1	2	6.9444		
Rudloff	18	PR-2	3	5.6667	.710	No instruction
Rudloff	18	PO-2	3	5.9444		
Rudloff	18	PO-1	2	6.9444	.004	Instruction
Rudloff	18	PO-1-B	2	10.0556		
Rudloff	18	PO-2	3	5.9444	.000	Instruction
Rudloff	18	PO-2-B	3	8.7222		
Albertini	18	PR-1	3	5.3889	.048	
Albertini	18	PR-2	2	6.7778		
Albertini	18	PR-1	3	5.3889	.000	Instruction
Albertini	18	PO-1	3	10.2778		
Albertini	18	PR-2	2	6.7778	.020	Instruction
Albertini	18	PO-2	2	9.1667		
Umbeck	19	PR-1	3	6.6842	.243	
Umbeck	19	PR-2	2	7.5263		
Umbeck	19	PR-1	3	6.6842	.055	No instruction
Umbeck	19	PO-1	3	7.8421		
Umbeck	19	PR-2	2	7.5263	.083	No instruction
Umbeck	19	PO-2	2	6.4211		Almost significant drop
Umbeck	19	PO-1	3	7.8421	.001	Instruction
Umbeck	19	PO-1-B	3	10.9474		
Umbeck	19	PO-2	2	6.4211	.001	Instruction
Umbeck	19	PO-2-B	2	10.3158		

Appendix H-1

SUMMARY OF 1984-85 STATISTICAL TESTS
Analysis of Covariance

Teacher	Number of Students	Test	Form	Unadjusted Mean	Adjusted Mean	Probability Level
Sheets	19	PO-2	3	7.32	6.58	.001
Rudloff	18	PO-2-B	3	8.78	9.56	
Sheets	19	PO-1	2	8.89	8.05	.002
Rudloff	18	PO-1-B	2	10.06	10.94	
Sheets	19	PR-1	2	6.68	6.43	.992
Rudloff	18	PR-1	2	6.17	6.43	
Sheets	19	PR-2	3	5.32	5.12	.365
Rudloff	18	PR-2	3	5.67	5.88	
Sheets	19	PO-1	2	8.89	8.48	.232
Rudloff	18	PO-1	2	6.94	7.39	
Sheets	19	PO-2	3	7.32	6.59	.866
Rudloff	18	PO-2	3	5.94	6.71	

Appendix H-2

Albertini	18	PO-1	3	10.28	10.21	.333
Umbeck	19	PO-1-B	3	10.95	11.01	
Albertini	18	PO-2	2	9.17	9.12	.206
Umbeck	19	PO-2-B	2	10.32	10.37	
Albertini	18	PR-1	3	5.39	5.36	.041
Umbeck	19	PR-1	3	6.68	6.71	
Albertini	18	PR-2	2	6.78	6.74	.336
Umbeck	19	PR-2	2	7.53	7.55	
Albertini	18	PO-1	3	10.28	10.25	.004
Umbeck	19	PO-1	3	7.84	7.82	
Albertini	18	PO-2	2	9.17	9.13	.003
Umbeck	19	PO-2	2	6.42	6.46	